

Q1 : Choose the best answer

[10 Marks]

10

1- In a system with data rate of 1,000,000 bps, how long it takes to send 20 bits?

- a. 50 ms
- b. 50 μ s
- c. 20 ms
- d. 20 μ s

2- What is the bit period time for a cosine signal with frequency equals 1 KHz, Amplitude equals 0.5 V, and propagation speed equals 3×10^8 m/s

- a. 3 μ s
- b. 1 μ s
- c. 3 ms
- d. 1 ms

3- noise caused by irregular spikes, it lasts for short duration, and has high amplitude.

- a. White
- b. Crosstalk
- c. Thermal
- d. Impulse

4- Attenuation is one of the transmission impairments and it is an increasing function of

- a. Amplitude
- b. Frequency
- c. Phase
- d. None of the above

5- What are the advantages of NRZ schemes

- a. Easy to engineer
- b. Good bandwidth utilization
- c. Within bit synchronization
- d. Both a and b

6- The Nyquist theorem specifies the minimum sampling rate to be

- a. equal to the lowest frequency of a signal
- b. equal to the highest frequency of a signal
- c. twice the bandwidth of a signal
- d. twice the highest frequency of a signal

7- The rate defines the number of data elements sent in 1s; the rate is the number of signal elements sent in 1s.

- a. data; signal
- b. signal; data
- c. baud; bit
- d. none of the above

8- In encoding, we use three levels: positive, zero, and negative.

- a. unipolar
- b. bipolar
- c. polar
- d. none of the above

9- ASK, PSK, and FSK are examples of conversion.

- a. digital-to-digital
- b. digital-to-analog
- c. analog-to-analog
- d. analog-to-digital

10- Given two sine waves A and B, if the frequency of A is twice that of B, then the period of B is _____ that of A.

- a. one-half
- b. twice
- c. the same as
- d. indeterminate from

$$f_A = 2f_B$$
$$f_B = \frac{1}{2}f_A$$

$$T = \frac{1}{f_B} \Rightarrow T = \frac{1}{0.5f_A} = 2f_A$$

Q2 : Short calculations (show your work)

[10 Marks]

7

1. What is the total bandwidth for Ultra Low Frequency channels if the spectrum is between 300 Hz and 3 KHz?

$$B = 3000\text{Hz} - 300\text{Hz} = 2700\text{Hz}$$

2. What is the wave length of Sine wave with a bandwidth equals to 400 MHz with a propagation speed of 2.5×10^8 m/s?

$$\lambda = vT \rightarrow \lambda = v \frac{1}{f} \rightarrow \lambda = (2.5 \times 10^8) \frac{1}{400 \times 10^6}$$

$$\lambda = 0.625 \text{ m}$$

3. We Have a channel with 4 KHz bandwidth. If we want to send data at 100 kbps, what is the minimum SNRdb ? what is SNR?

$$C = B \log_2 (1 + \text{SNR}) \rightarrow (100 \times 10^3) = (4 \times 10^3) \log_2 (1 + \text{SNR})$$

$$\text{SNR} = 33.5 \text{ MHz} \rightarrow \text{SNR}_{\text{dB}} = 10 \log \text{SNR}$$

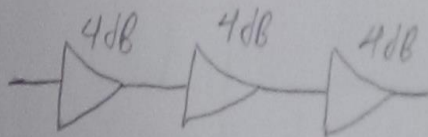
$$\text{SNR}_{\text{dB}} = 75.3 \text{ dB}$$

4. What is ratio 'r' values for ASK with eight different Amplitudes, and for BASK?

$$r = \log_2 L \rightarrow r = \log_2 8 \rightarrow r = 3$$

$$\text{BASK} = 1$$

5. A signal passes through three cascaded amplifiers, each with 4 dB gain, What is the total gain? How much is the signal has been amplified?



$$4 + 4 + 4 = 12 \text{ dB}$$

$$\text{dB} = 10 \log(\text{ratio})$$

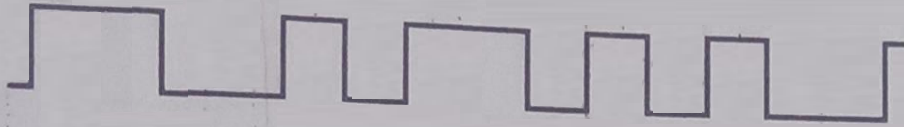
$$12 = 10 \log(\text{ratio})$$

$$\text{ratio} = 15.85$$

The waveform in the figure below belongs to a Manchester Encoder.

[6 Marks]

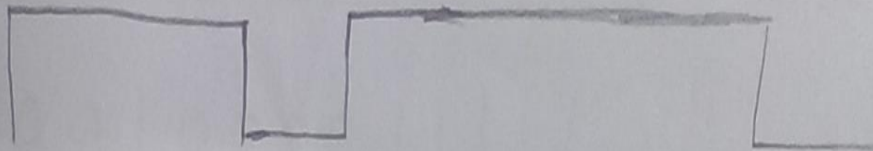
- a- Determine the beginning and end of bit periods



- b- Write the data sequence.

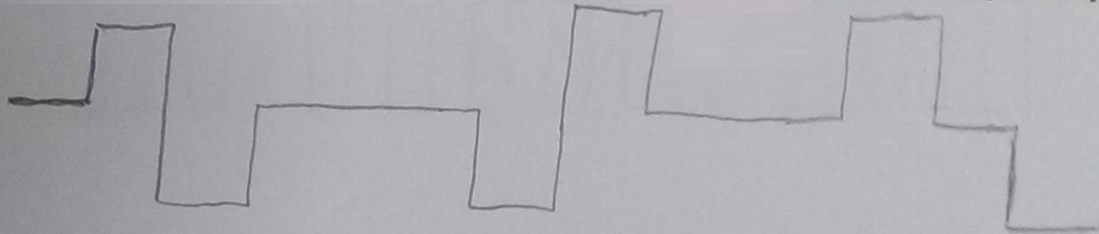
1 0 1 1 0 0 0 1

- c- Sketch the data sequence using NRZ-I encoding, if the preceding bit was negative (low).

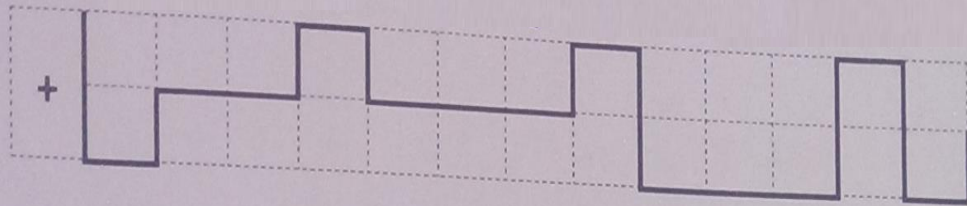


Q4 : Sketch the HDB3 waveform, if the input data stream is "011 000 000 000 1", assuming the most recent preceding 1 bit for the bipolar-AMI code has negative voltage and it is preceded with odd number of 1 bit.

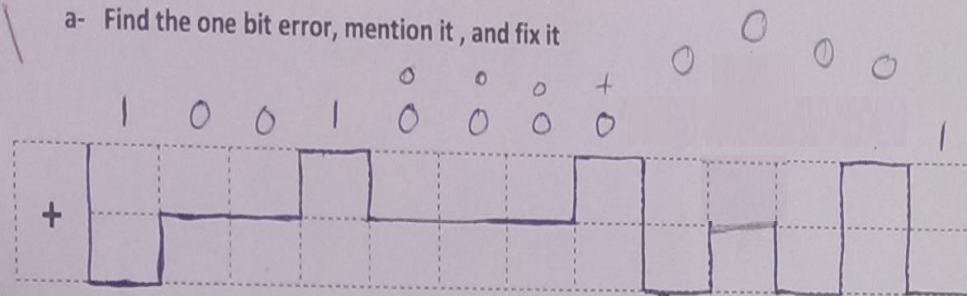
[4 Marks]



Q5 : The waveform below represents a bit stream that is encoded using B8ZS scheme. Assuming that the most recent preceding 1 bit for the bipolar-AMI code has a positive voltage and this bit stream comes after a block of processed zeros. [10 Marks]



a- Find the one bit error, mention it, and fix it

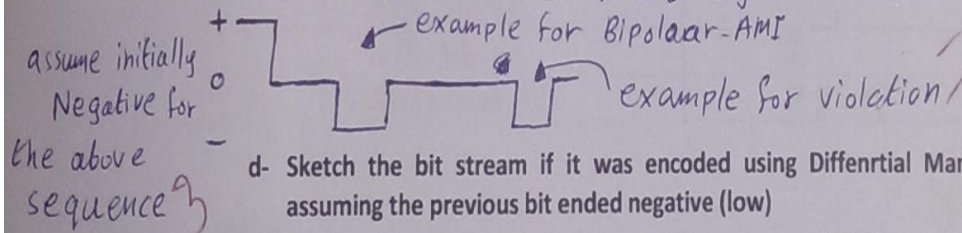


b- Write down the bit sequence this signal is representing

0 0 0 0
1 0 0 1 0 0 0 0 1

c- What is a the Bipolar-AMI rule and what is a Violation? Show an example of each at the above signal.

Bipolar-AMI: can't have same voltage sign respectively ✓
Violation: violate the last voltage sign. ✓



d- Sketch the bit stream if it was encoded using Differential Manchester scheme assuming the previous bit ended negative (low)

